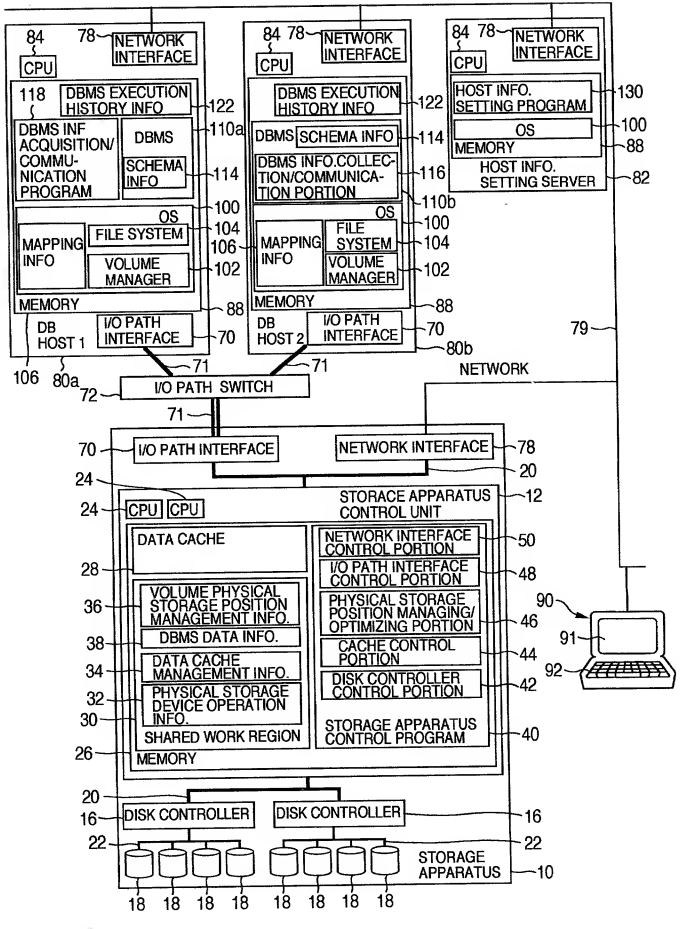
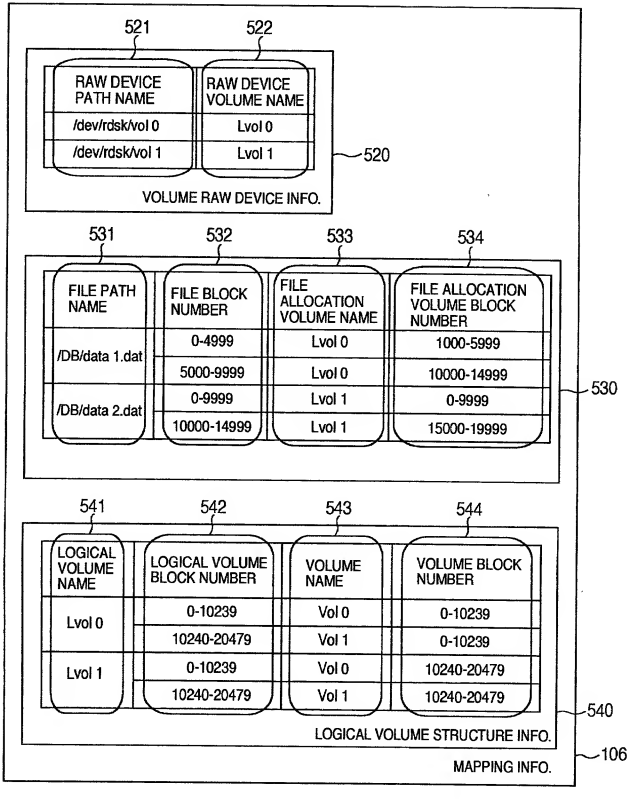
FIG.1



20220-4334807

FIG.2


521
522
RAW DEVICE PATH NAME
RAW DEVICE VOLUME NAME
/dev/rdsk/vol 0
Lvol 0
/dev/rdsk/vol 1
Lvol 1
520
VOLUME RAW DEVICE INFO.
531
532
533
534
FILE PATH NAME
FILE BLOCK NUMBER
FILE ALLOCATION VOLUME NAME
FILE ALLOCATION VOLUME BLOCK NUMBER
/DB/data 1.dat
0-4999
Lvol 0
1000-5999
5000-9999
Lvol 0
10000-14999
/DB/data 2.dat
0-9999
Lvol 1
0-9999
10000-14999
Lvol 1
15000-19999
530
541
542
543
544
LOGICAL VOLUME NAME
LOGICAL VOLUME BLOCK NUMBER
VOLUME NAME
VOLUME BLOCK NUMBER
Lvol 0
0-10239
Vol 0
0-10239
10240-20479
Vol 1
0-10239
Lvol 1
0-10239
Vol 0
10240-20479
10240-20479
Vol 1
10240-20479
540
LOGICAL VOLUME STRUCTURE INFO.
106
MAPPING INFO.

10033514-022702

FIG.3

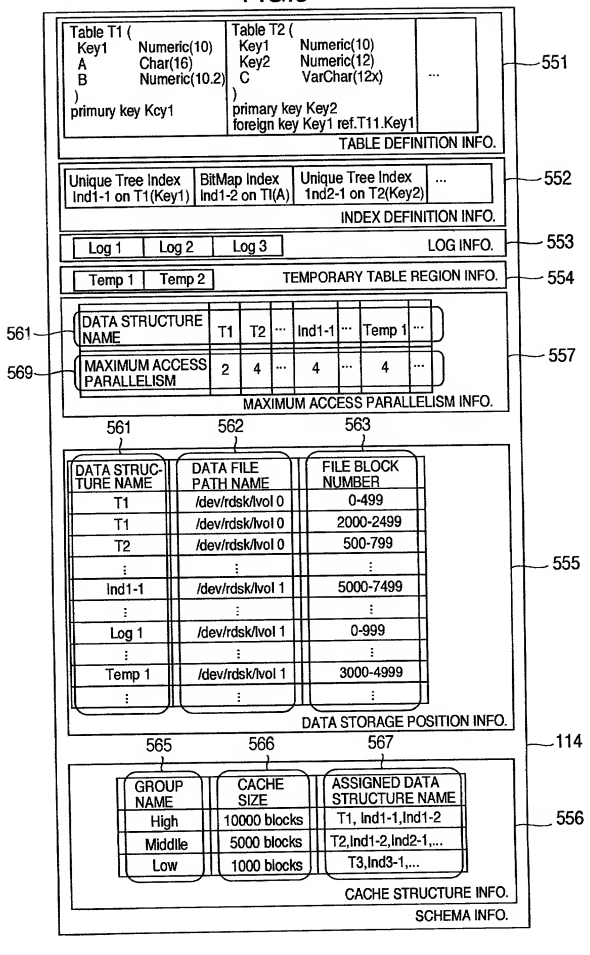


FIG.4

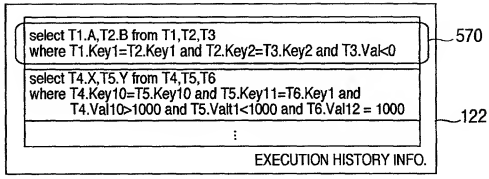
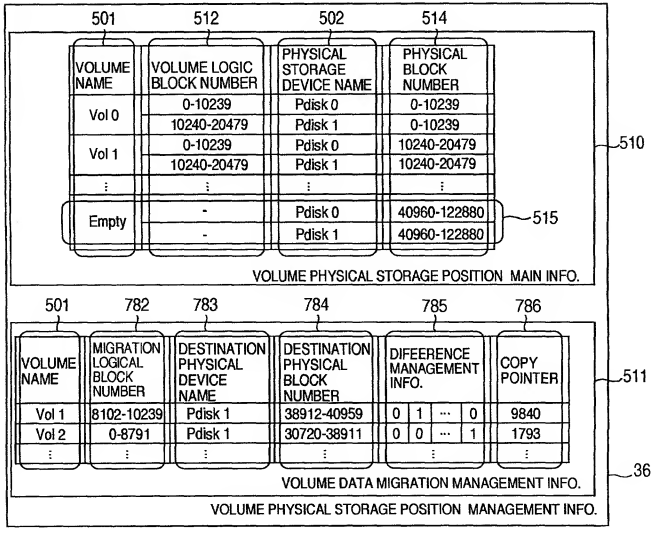


FIG.5



20070227 US 2007033544 A1

FIG.6

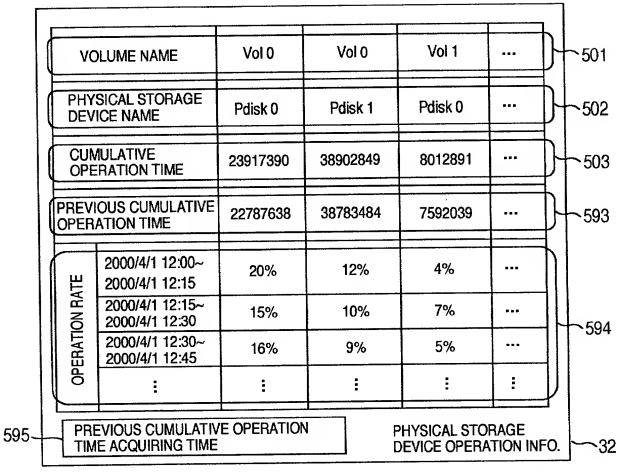
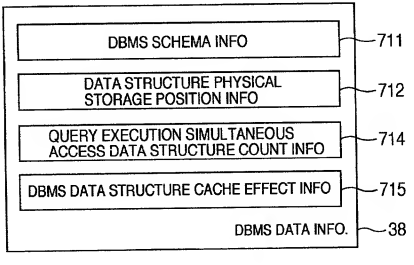
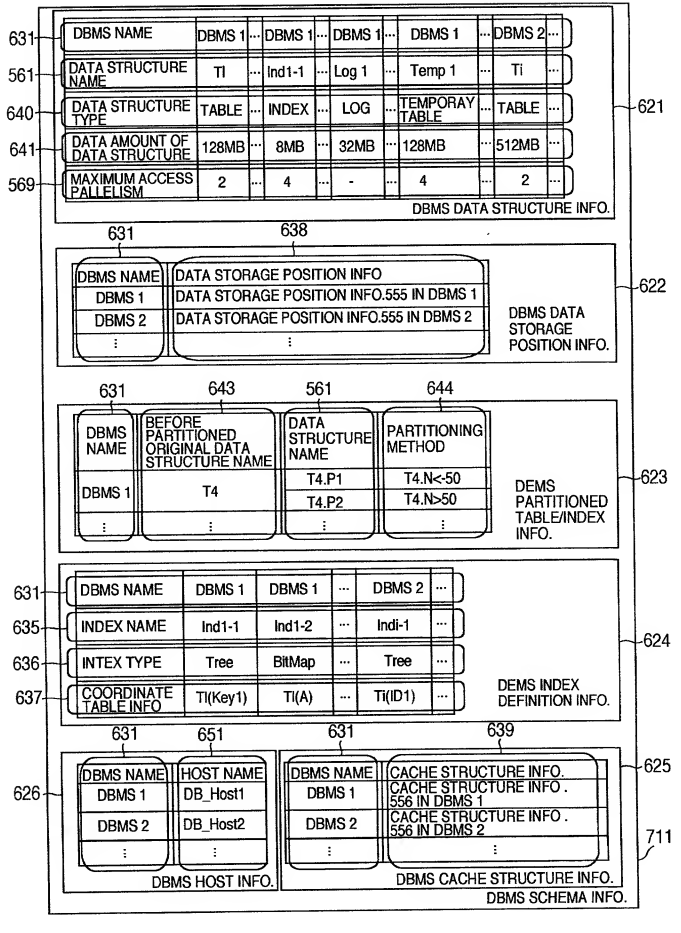


FIG.7



20220'4553801

FIG.8



10023534-022702

FIG.9

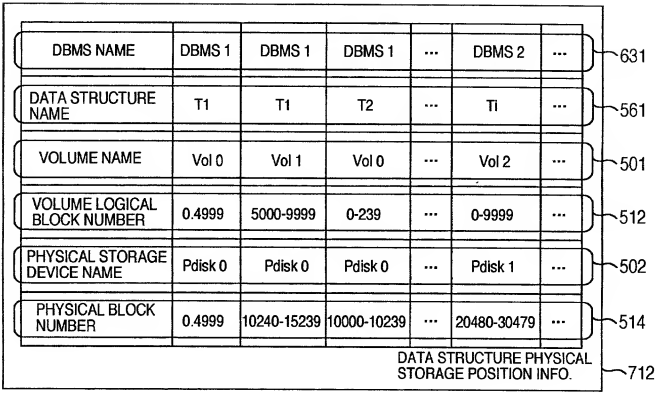

DBMS NAME
DBMS 1
DBMS 1
DBMS 1
DBMS 2
631
DATA STRUCTURE NAME
T1
T1
T2
Ti
561
VOLUME NAME
Vol 0
Vol 1
Vol 0
Vol 2
501
VOLUME LOGICAL BLOCK NUMBER
0.4999
5000-9999
0-239
0-9999
512
PHYSICAL STORAGE DEVICE NAME
Pdisk 0
Pdisk 0
Pdisk 0
Pdisk 1
502
PHYSICAL BLOCK NUMBER
0.4999
10240-15239
10000-10239
20480-30479
514
DATA STRUCTURE PHYSICAL STORAGE POSITION INFO.
712

FIG.10

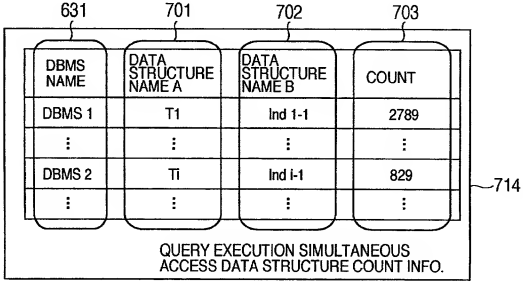

631
701
702
703
DBMS NAME
DATA STRUCTURE NAME A
DATA STRUCTURE NAME B
COUNT
DBMS 1
T1
Ind 1-1
2789
DBMS 2
Ti
Ind i-1
829
714
QUERY EXECUTION SIMULTANEOUS ACCESS DATA STRUCTURE COUNT INFO.

FIG.11

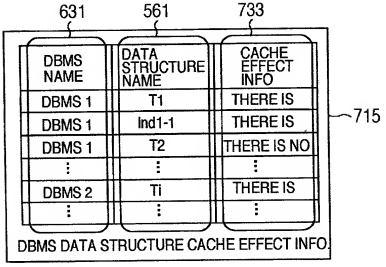

631
561
733
DBMS NAME
DATA STRUCTURE NAME
CACHE EFFECT INFO
DBMS 1
T1
THERE IS
DBMS 1
Ind1-1
THERE IS
DBMS 1
T2
THERE IS NO
DBMS 2
Ti
THERE IS
715
DBMS DATA STRUCTURE CACHE EFFECT INFO.

FIG.12

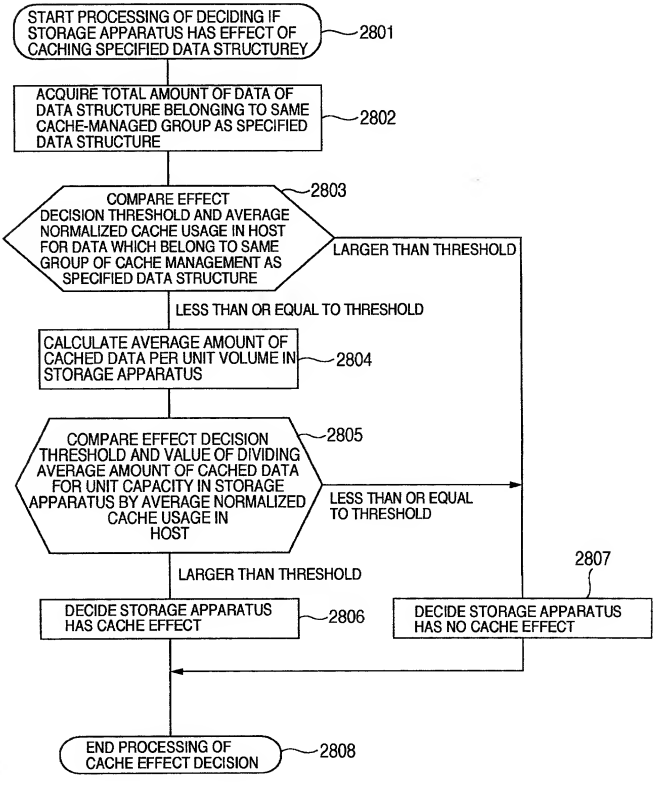
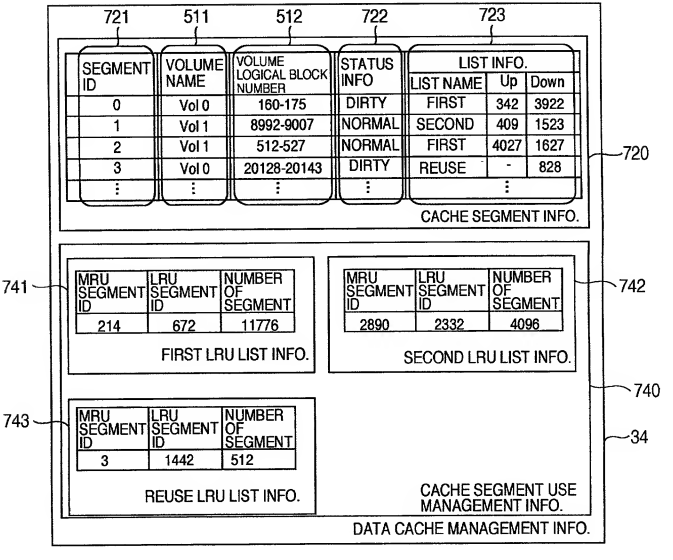
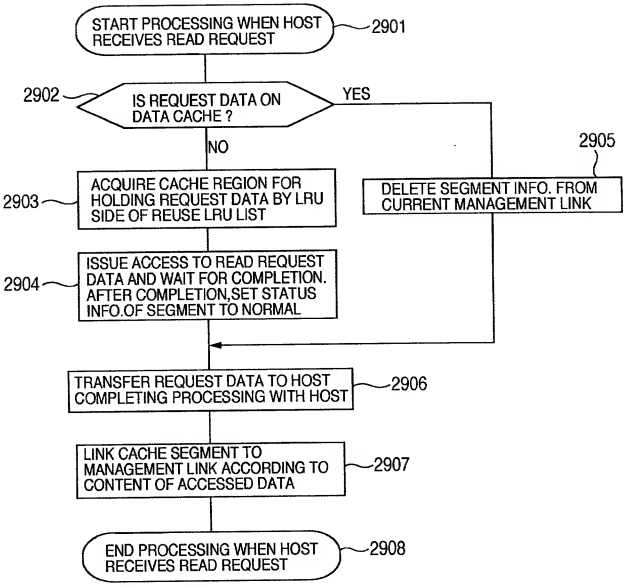

START PROCESSING OF DECIDING IF STORAGE APPARATUS HAS EFFECT OF CACHING SPECIFIED DATA STRUCTUREY
2801
ACQUIRE TOTAL AMOUNT OF DATA OF DATA STRUCTURE BELONGING TO SAME CACHE-MANAGED GROUP AS SPECIFIED DATA STRUCTURE
2802
COMPARE EFFECT DECISION THRESHOLD AND AVERAGE NORMALIZED CACHE USAGE IN HOST FOR DATA WHICH BELONG TO SAME GROUP OF CACHE MANAGEMENT AS SPECIFIED DATA STRUCTURE
2803
LARGER THAN THRESHOLD
LESS THAN OR EQUAL TO THRESHOLD
CALCULATE AVERAGE AMOUNT OF CACHED DATA PER UNIT VOLUME IN STORAGE APPARATUS
2804
COMPARE EFFECT DECISION THRESHOLD AND VALUE OF DIVIDING AVERAGE AMOUNT OF CACHED DATA FOR UNIT CAPACITY IN STORAGE APPARATUS BY AVERAGE NORMALIZED CACHE USAGE IN HOST
2805
LESS THAN OR EQUAL TO THRESHOLD
LARGER THAN THRESHOLD
2807
DECIDE STORAGE APPARATUS HAS CACHE EFFECT
2806
DECIDE STORAGE APPARATUS HAS NO CACHE EFFECT
END PROCESSING OF CACHE EFFECT DECISION
2808

FIG.13



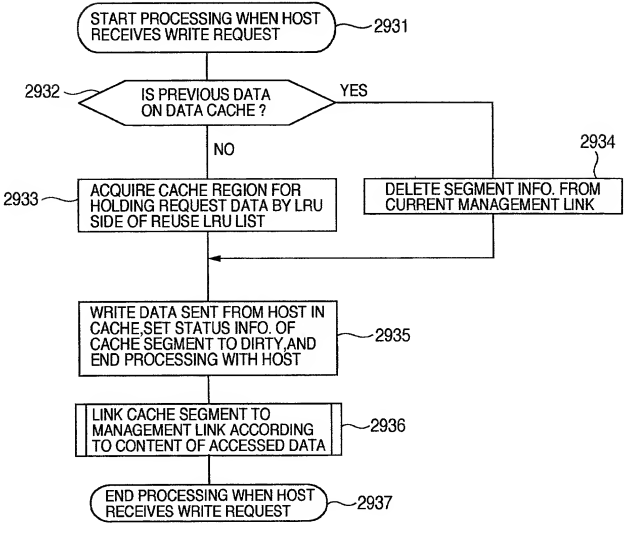
20220-1538001

FIG.14



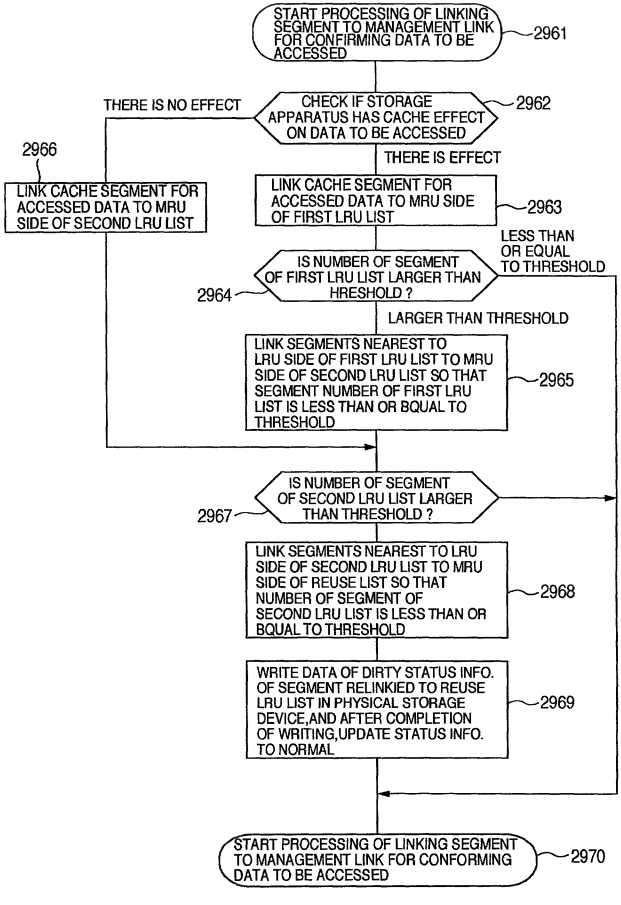
20220134523800T

FIG.15



20220-453201.0001

FIG.16



20702-022702 1008334801

20220-45380T

FIG.17

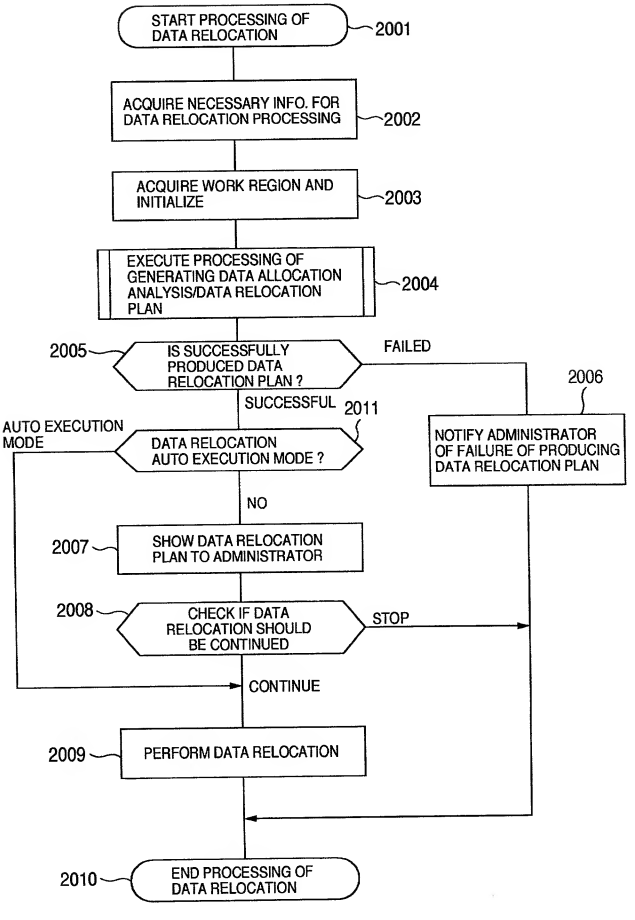
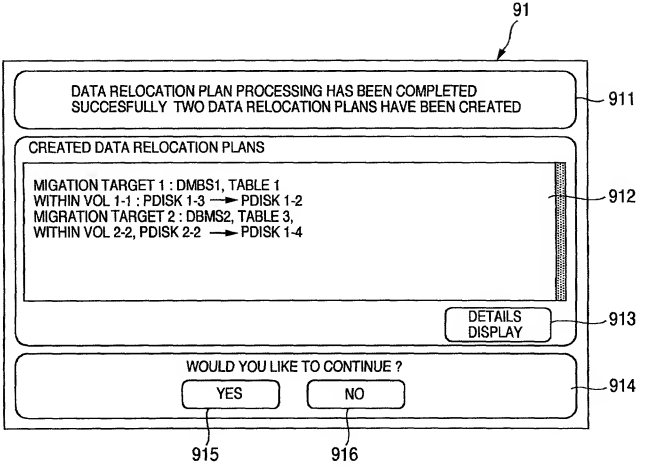


FIG.18



20220445380011

FIG.19

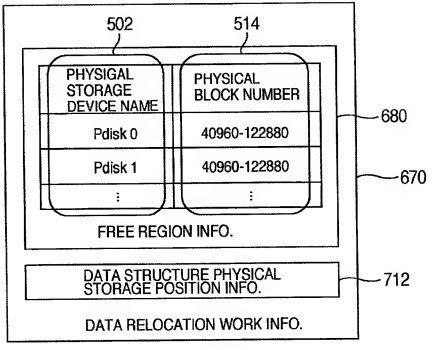
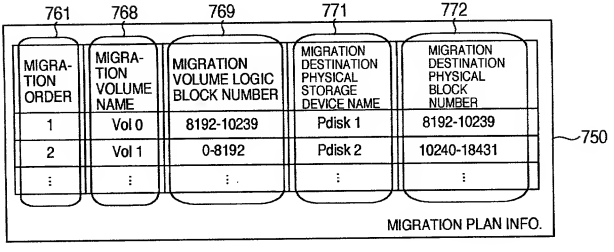
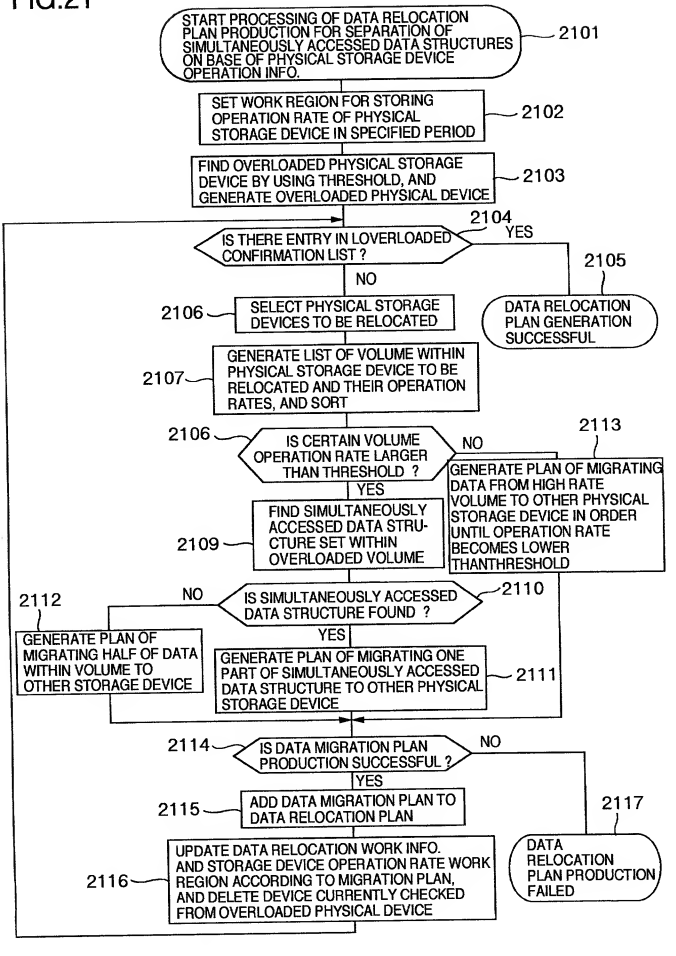


FIG.20



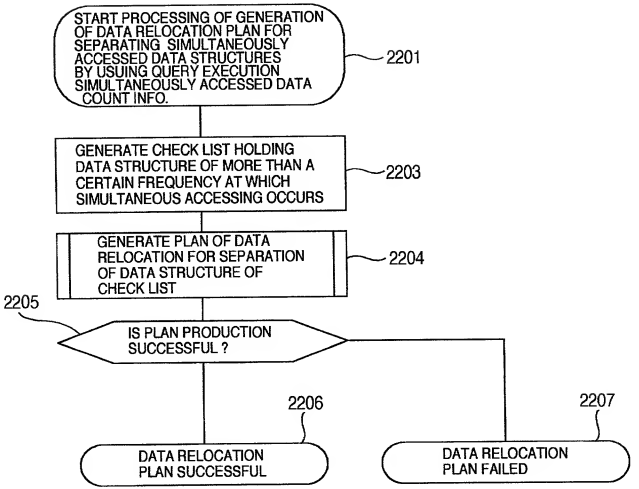
20220-1534-1008

FIG.21



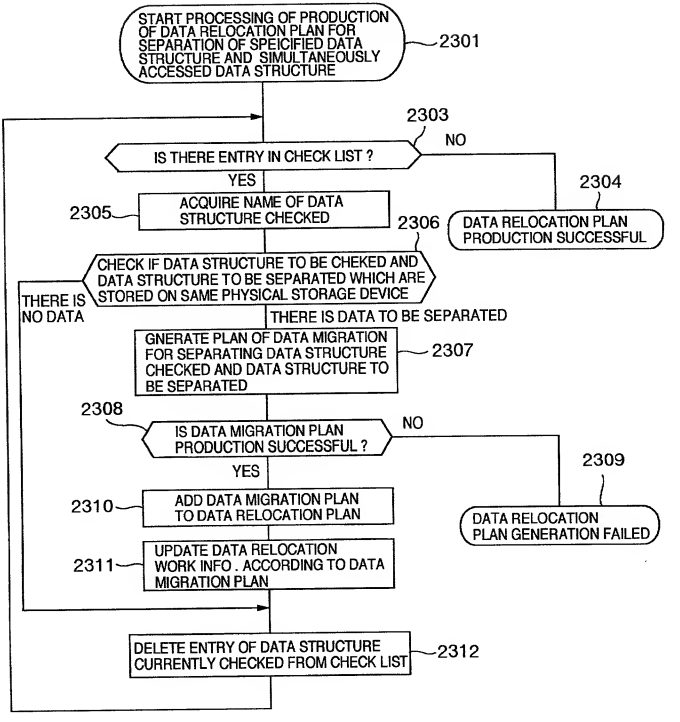
20220-1008354

FIG.22



20220-1008354.02.801

FIG.23



10083544.022702

1003354.022702

FIG.24

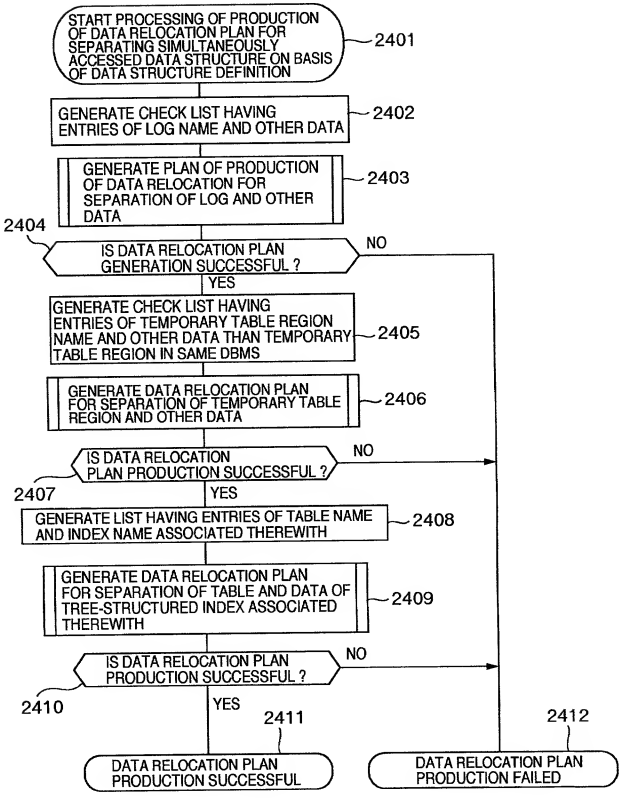
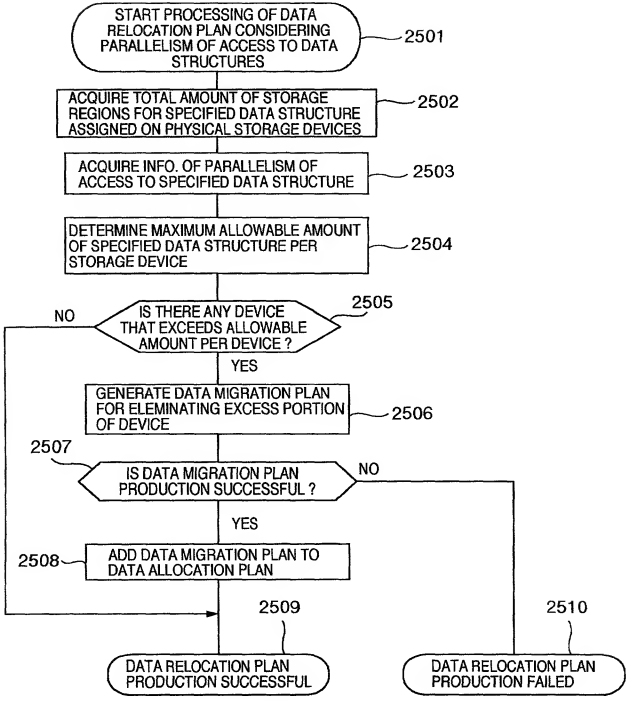
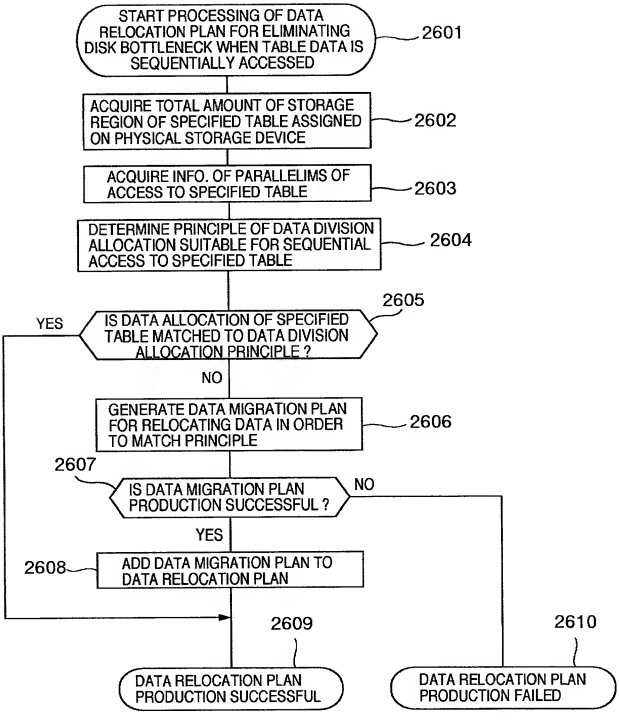


FIG.25



20220454003300

FIG.26



20070220-4SE3001

FIG.27

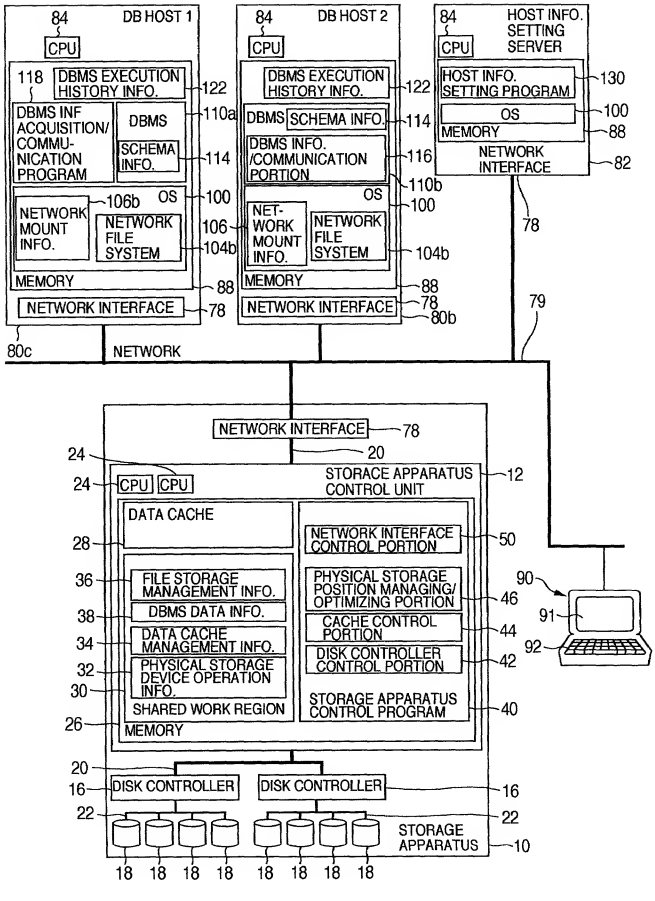

84
DB HOST 1
CPU
118
DBMS EXECUTION HISTORY INFO.
122
DBMS INF ACQUISITION/ COMMU-NICATION PROGRAM
DBMS
SCHEMA INFO.
110a
114
OS
100
NETWORK MOUNT INFO.
106b
NETWORK FILE SYSTEM
106
104b
MEMORY
88
NETWORK INTERFACE
78
80c
84
DB HOST 2
CPU
DBMS EXECUTION HISTORY INFO.
122
DBMS
SCHEMA INFO.
114
DBMS INFO. /COMMUNICATION PORTION
116
110b
OS
100
NET-WORK MOUNT INFO.
NETWORK FILE SYSTEM
104b
MEMORY
88
NETWORK INTERFACE
78
80b
84
HOST INFO. SETTING SERVER
CPU
HOST INFO. SETTING PROGRAM
130
OS
100
MEMORY
88
NETWORK INTERFACE
82
78
79
NETWORK
NETWORK INTERFACE
78
20
24
CPU
CPU
STORACE APPARATUS CONTROL UNIT
12
DATA CACHE
28
NETWORK INTERFACE CONTROL PORTION
50
36
FILE STORAGE MANAGEMENT INFO.
38
DBMS DATA INFO.
34
DATA CACHE MANAGEMENT INFO.
32
PHYSICAL STORAGE DEVICE OPERATION INFO.
30
SHARED WORK REGION
26
MEMORY
PHYSICAL STORAGE POSITION MANAGING/ OPTIMIZING PORTION
46
CACHE CONTROL PORTION
44
DISK CONTROLLER CONTROL PORTION
42
STORAGE APPARATUS CONTROL PROGRAM
40
90
91
92
20
16
DISK CONTROLLER
DISK CONTROLLER
16
22
22
STORAGE APPARATUS
10
18
18
18
18
18
18
18
18

FIG.28

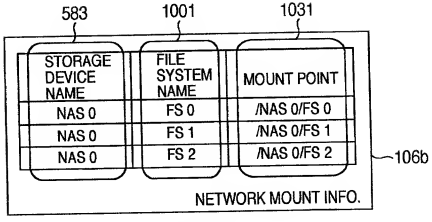

583
1001
1031
STORAGE DEVICE NAME
FILE SYSTEM NAME
MOUNT POINT
NAS 0
FS 0
/NAS 0/FS 0
NAS 0
FS 1
/NAS 0/FS 1
NAS 0
FS 2
/NAS 0/FS 2
106b
NETWORK MOUNT INFO.

FIG.29

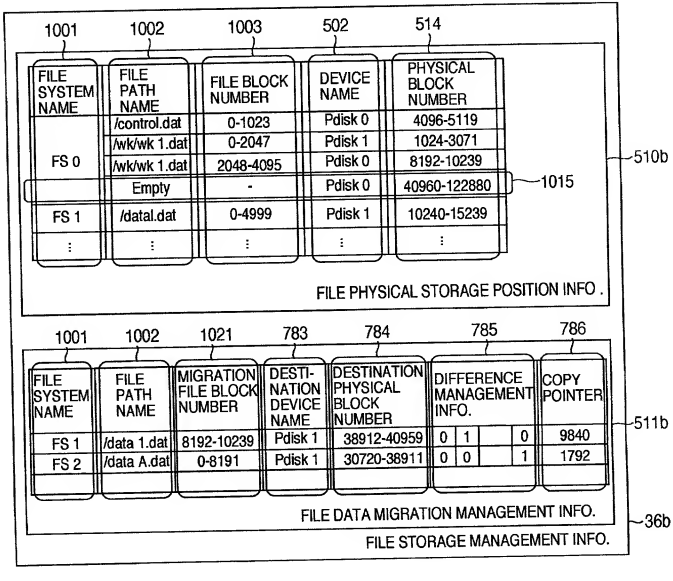

1001
1002
1003
502
514
FILE SYSTEM NAME
FILE PATH NAME
FILE BLOCK NUMBER
DEVICE NAME
PHYSICAL BLOCK NUMBER
FS 0
/control.dat
0-1023
Pdisk 0
4096-5119
/wk/wk 1.dat
0-2047
Pdisk 1
1024-3071
/wk/wk 1.dat
2048-4095
Pdisk 0
8192-10239
Empty
-
Pdisk 0
40960-122880
1015
FS 1
/datal.dat
0-4999
Pdisk 1
10240-15239
510b
FILE PHYSICAL STORAGE POSITION INFO .
1001
1002
1021
783
784
785
786
FILE SYSTEM NAME
FILE PATH NAME
MIGRATION FILE BLOCK NUMBER
DESTI-NATION DEVICE NAME
DESTINATION PHYSICAL BLOCK NUMBER
DIFFERENCE MANAGEMENT INFO.
COPY POINTER
FS 1
/data 1.dat
8192-10239
Pdisk 1
38912-40959
0 1 0
9840
FS 2
/data A.dat
0-8191
Pdisk 1
30720-38911
0 0 1
1792
511b
FILE DATA MIGRATION MANAGEMENT INFO.
36b
FILE STORAGE MANAGEMENT INFO.

FIG.30

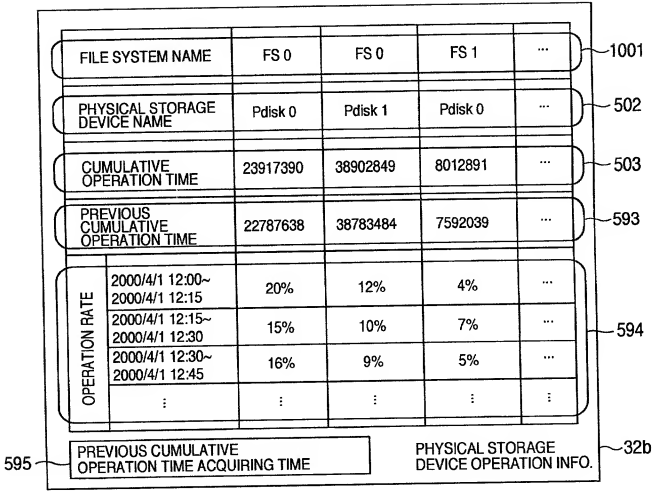
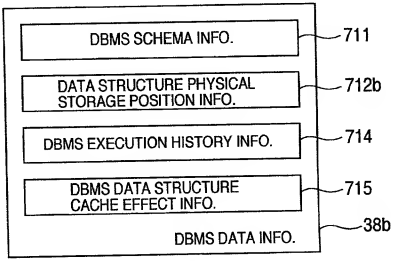

FILE SYSTEM NAME
FS 0
FS 0
FS 1
...
1001
PHYSICAL STORAGE DEVICE NAME
Pdisk 0
Pdisk 1
Pdisk 0
...
502
CUMULATIVE OPERATION TIME
23917390
38902849
8012891
...
503
PREVIOUS CUMULATIVE OPERATION TIME
22787638
38783484
7592039
...
593
OPERATION RATE
2000/4/1 12:00~ 2000/4/1 12:15
20%
12%
4%
...
2000/4/1 12:15~ 2000/4/1 12:30
15%
10%
7%
...
594
2000/4/1 12:30~ 2000/4/1 12:45
16%
9%
5%
...
595
PREVIOUS CUMULATIVE OPERATION TIME ACQUIRING TIME
PHYSICAL STORAGE DEVICE OPERATION INFO.
32b

FIG.31


DBMS SCHEMA INFO.
711
DATA STRUCTURE PHYSICAL STORAGE POSITION INFO.
712b
DBMS EXECUTION HISTORY INFO.
714
DBMS DATA STRUCTURE CACHE EFFECT INFO.
715
DBMS DATA INFO.
38b

20220-1SC3800T

FIG.32

DBMS NAME	DBMS 1	DBMS 1	DBMS 1	...	DBMS 2	...	631
DATA STRUCTURE NAME	T1	T1	T2	...	Ti	...	561
FILE SYSTEM NAME	FS 1	FS 1	FS 1	...	FS 2	...	1001
FILE PATH NAME	/data 1.dat	/data 1.dat	/data 2.dat	...	/data i.dat	...	1002
FILE BLOCK NUMBER	0-4999	5000-9999	0-4999	...	0-9999	...	1003
PHYSICAL STORAGE DEVICE NAME	Pdisk 1	Pdisk 0	Pdisk 1	...	Pdisk 2	...	514
PHYSICAL BLOCK NUMBER	10240-15239	10240-15239	15240-20239	...	20480-30479	...	502

DATA STRUCTURE PHYSICAL STORAGE POSITION INFO. 712b

FIG.33

721 1001 1002 1003 722 723

SEGMENT ID	FILE SYSTEM NAME	FILE PATH NAME	FILE BLOCK NUMBER	STATUS INFO.	LIST INFO.		
					LIST NAME	Up	Down
0	FS 1	/data 1.dat	160-175	DIRTY	FIRST	342	3922
1	FS 2	/data i.dat	8992-9007	NORMAL	SECOND	409	1523
2	FS 1	/data 1.dat	512- 527	NORMAL	FIRST	4027	1627
3	FS 0	/control.dat	0-15	WRITE	REUSE	-	828
⋮	⋮	⋮	⋮	⋮	⋮		

720b

CACHE SEGMENT INFO.

741

MRU SEGMENT ID	LRU SEGMENT ID	NUMBER OF SEGMENT
214	672	11776

FIRST LRU LIST INFO

MRU SEGMENT ID	LRU SEGMENT ID	NUMBER OF SEGMENT
2890	2332	4096

742

SECOND LRU LIST INFO.

743

MRU SEGMENT ID	LRU SEGMENT ID	NUMBER OF SEGMENT
3	1442	512

REUSED LRU LIST INFO

740

CACHE SEGMENT USE MANAGEMENT INFO.

34b

DATA CACHE MANAGEMENT INFO.

FIG.34

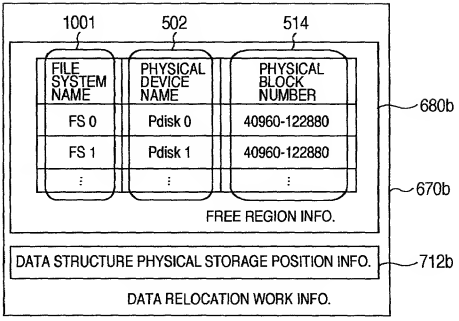
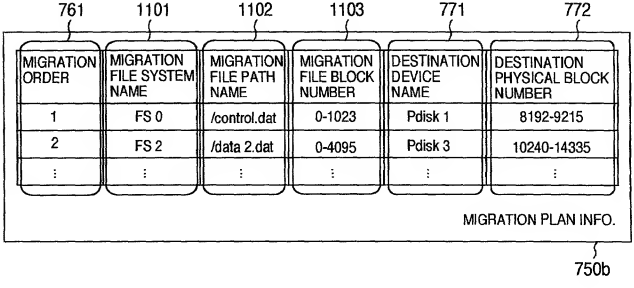

1001
502
514
FILE SYSTEM NAME
PHYSICAL DEVICE NAME
PHYSICAL BLOCK NUMBER
FS 0
Pdisk 0
40960-122880
FS 1
Pdisk 1
40960-122880
680b
670b
FREE REGION INFO.
DATA STRUCTURE PHYSICAL STORAGE POSITION INFO.
712b
DATA RELOCATION WORK INFO.

FIG.35


761
1101
1102
1103
771
772
MIGRATION ORDER
MIGRATION FILE SYSTEM NAME
MIGRATION FILE PATH NAME
MIGRATION FILE BLOCK NUMBER
DESTINATION DEVICE NAME
DESTINATION PHYSICAL BLOCK NUMBER
1
FS 0
/control.dat
0-1023
Pdisk 1
8192-9215
2
FS 2
/data 2.dat
0-4095
Pdisk 3
10240-14335
MIGRATION PLAN INFO.
750b